

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

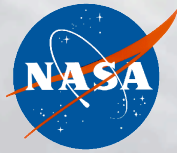
A Multi-sensor Water Vapor Climate Data Record Using Cloud Classification

**Eric Fetzer, Evan Fishbein, Brian Kahn, Bjorn Lambrigtsen,
Bil Read and Brian Wilson**

Jet Propulsion Laboratory, California Institute of Technology

The GES DISC MEaSUREs Working Group Meeting

NASA Goddard, 29 April 2009



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Overview

- **Hypothesis** Climate change will be manifested as simultaneous changes in clouds, water vapor and temperature.
- **Approach** Exploit cloud and moist thermodynamic information simultaneous.
- **Rationale** Changes in clouds imply changes in viewing conditions for MW-IR sensors providing high resolution, low noise profiles (TOVS, AIRS, IASI, CrIMSS). *Note:* holds even for current observations.



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Furthermore...

We are working with NVAP Project (PI Tom Vonder Haar, CSU) in producing a long-term water vapor record from all sensors.

- **Our integrated approach:**
 - *NVAP will focus on the pre-A-Train data sets.*
 - *JPL will examine sampling effects in the detailed A-Train record*
 - Currently examining CloudSat-AIRS matches, focusing on cloud classes.
 - Will generate CloudSat-MLS and CloudSat-AMSR-E next.
 - Examining MODIS for complete characterization.
 - Ultimate goal: separable trends in water vapor and clouds.



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Our Data Sets

- **EOS era:**
 - ***Water vapor:***
 - A-Train: AIRS, AMSR-E, MLS, (maybe MODIS).
 - ***Cloud Properties:***
 - A-Train: CloudSat Cloud Classes, MODIS, others?
- **Pre-EOS**
 - ***NOAA MW sounders (with NVAP).***
 - ***Radiosondes (with NVAP).***
 - ***Other: ISCCP.***



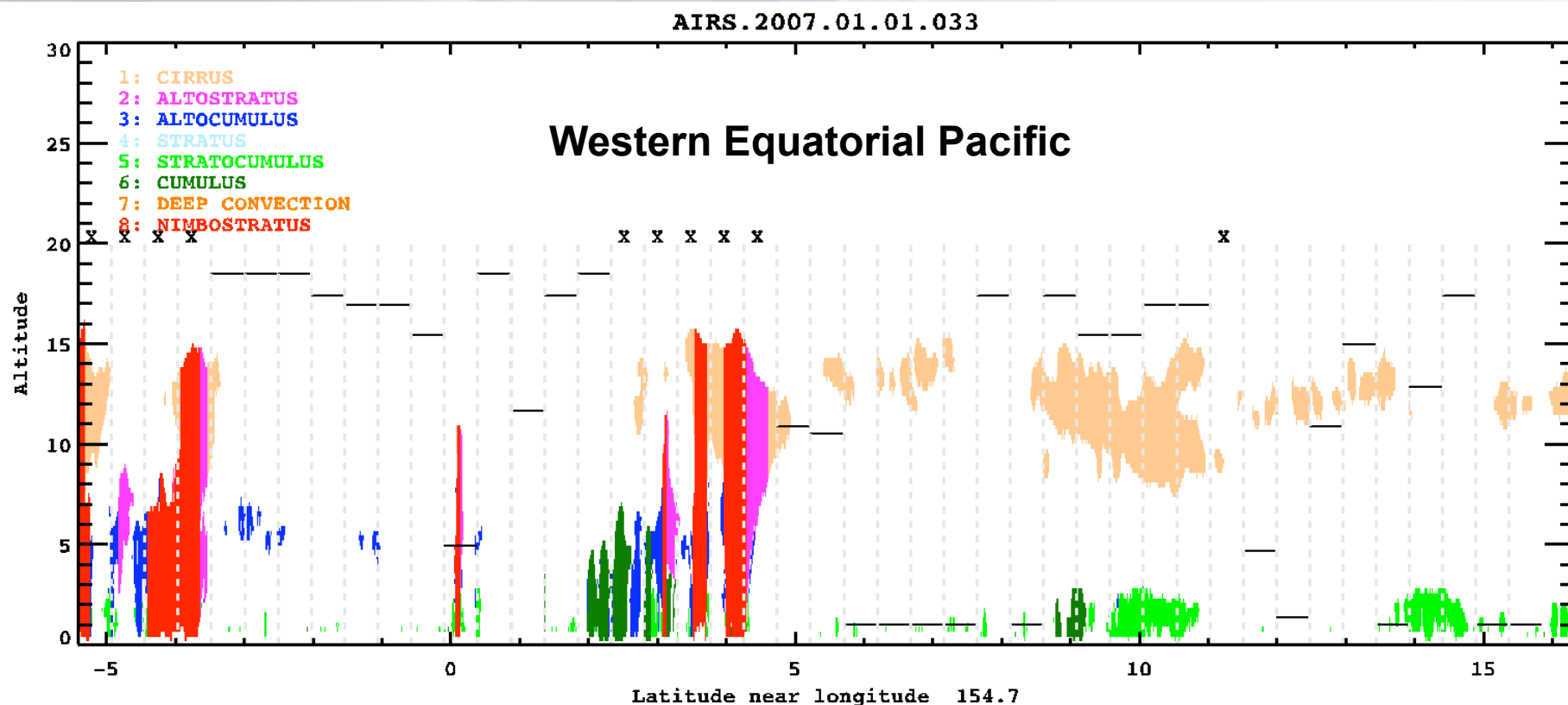
National Aeronautics and
Space Administration

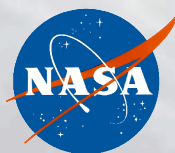
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

AIRS-CloudSat Matched Data

Color fill: CloudSat Classes (Sassen and Wang, 2008, GRL)

Gray verticals: matched AIRS profile boundaries.
Black horizontals: AIRS 'best' retrieval altitude (from 'PBest').
X: no AIRS tropospheric profiling.





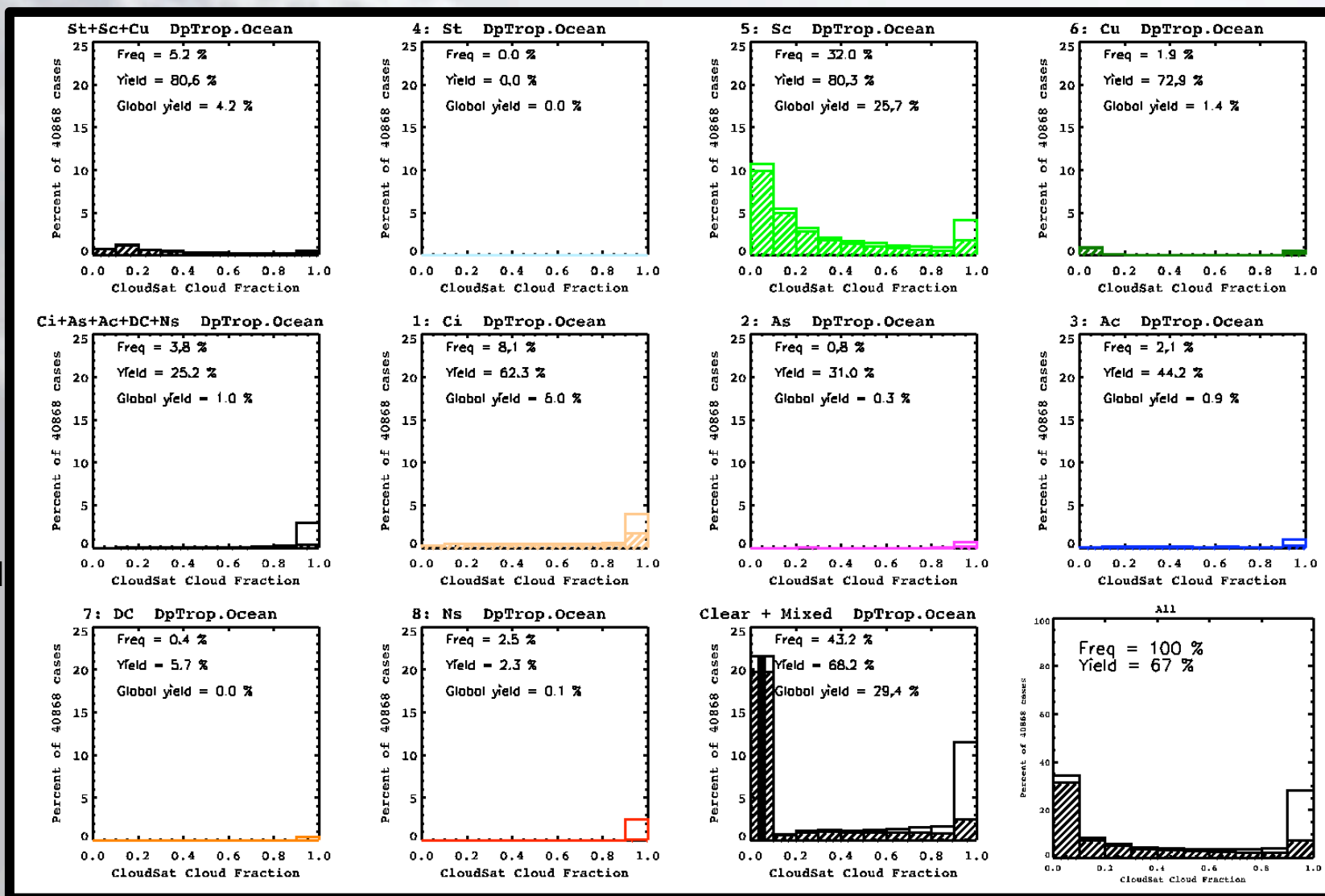
National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Relating AIRS retrieval performance to CloudSat cloud class and fraction *January 2007, 15S-15N, Ocean only*

No Fill:
percent of
AIRS scenes
of that
CloudSat
cloud type &
fraction.

Fill:
percent of
AIRS scenes
with retrieval
to surface.





National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Confirming AIRS Retrieval Performance Varies with CloudSat Cloud Class

1) Shallow Clouds

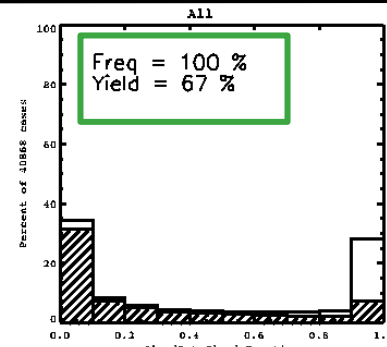
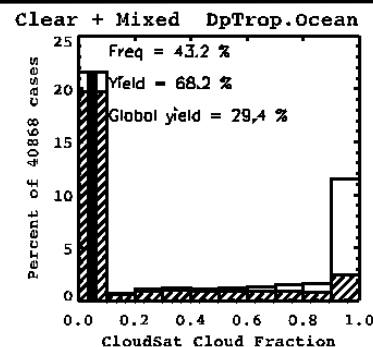
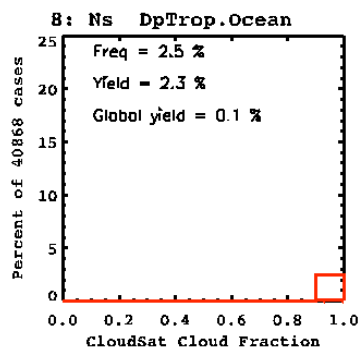
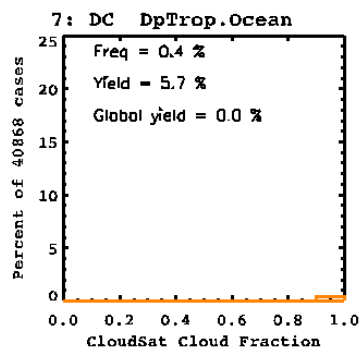
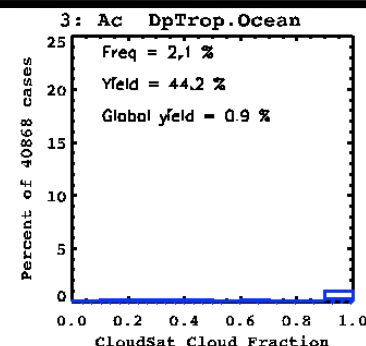
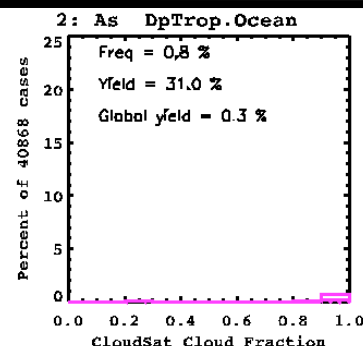
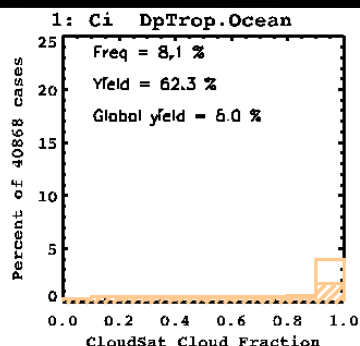
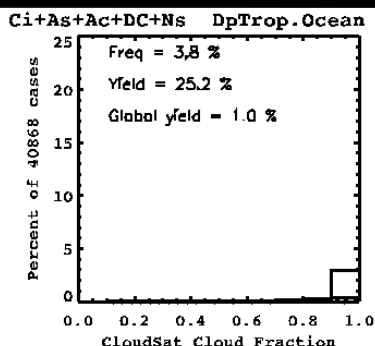
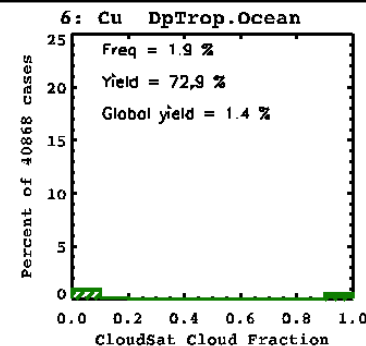
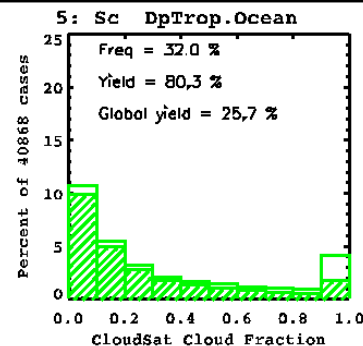
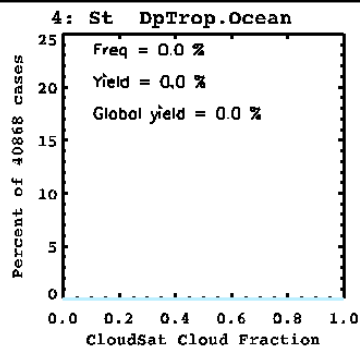
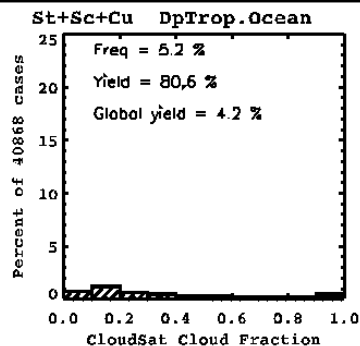
40% of
all scenes

Yields are
~80%.

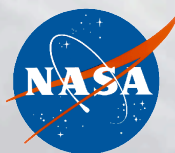
2) Deep Clouds

17% of
all scenes

Yields are
~2 to 63%.



3) Clear & Mixed; ~43% of scenes; Yield is 68%.



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Confirming AIRS Water Vapor Varies between CloudSat Cloud Classes

Plots relative to overall mean.

1) Shallow Clouds

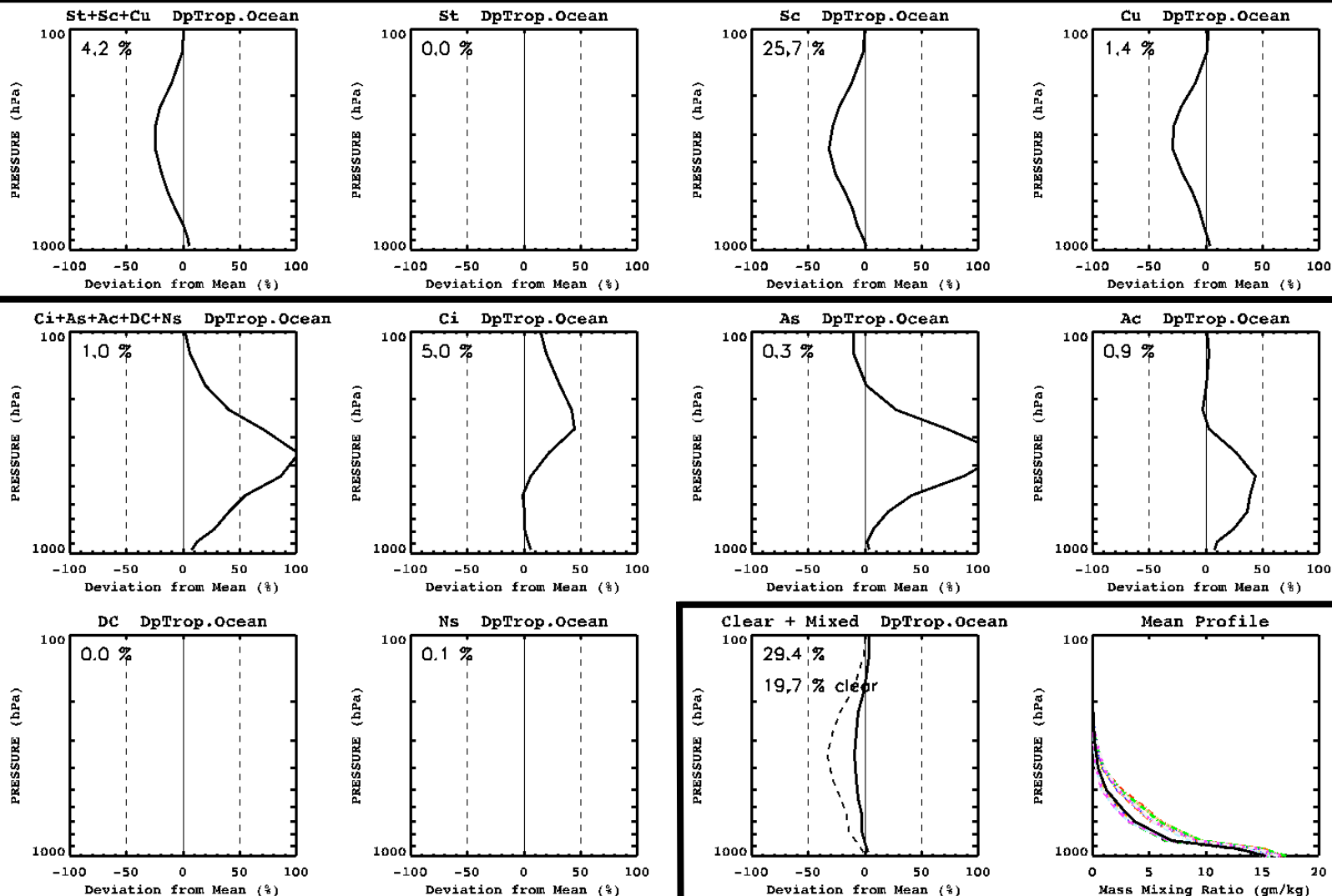
~40% of
all scenes

~25% drier
than mean

2) Deep Clouds

~17% of
all scenes

~50-120%
wetter
than mean



3) Clear & Mixed; Drier than mean.